

Title: Synoptic Traveling Weather Systems on Mars: Effects of Radiatively-Active Water Ice Clouds

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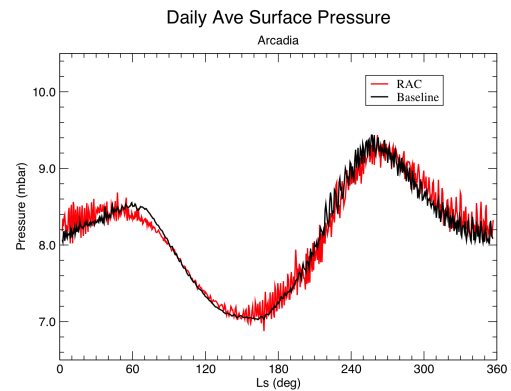
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Topic: Planetary Atmospheres and Climate

Atmospheric aerosols on Mars are critical in determining the nature of its thermal structure, its large-scale circulation, and hence the overall climate of the planet. We conduct multi-annual simulations with the latest version of the NASA Ames Mars global climate model (GCM), gcm2.3+, that includes a modernized radiative-transfer package and complex water-ice cloud microphysics package which permit radiative effects and interactions of suspended atmospheric aerosols (e.g., water ice clouds, water vapor, dust, and mutual interactions) to influence the net diabatic heating. Results indicate that radiatively active water ice clouds profoundly affect the seasonal and annual mean climate. The mean thermal structure and balanced circulation patterns are strongly modified near the surface and aloft. Warming of the subtropical atmosphere at altitude and cooling of the high latitude atmosphere at low levels takes place, which increases the mean pole-to-equator temperature contrast (i.e., "baroclinicity"). With radiatively active water ice clouds (RAC) compared to radiatively inert water ice clouds (nonRAC), significant changes in the intensity of the mean state and forced stationary Rossby modes occur, both of which affect the vigor and intensity of traveling, synoptic period weather systems.

Such weather systems not only act as key agents in the transport of heat and momentum beyond the extent of the Hadley circulation, but also the transport of trace species such as water vapor, water ice-clouds, dust and others.



The northern hemisphere (NH) forced Rossby waves and resultant wave train are augmented in the RAC case: the modes are more intense and the wave train is shifted equatorward. Significant changes also occur within the subtropics and tropics. The Rossby wave train sets up, combined with the traveling synoptic-period weather systems (i.e., cyclones and anticyclones), the geographic extent of storm zones (or storm tracks) within the NH. A variety of circulation features will be presented which indicate contrasts between the RAC and nonRAC cases, and which highlight key effects radiatively-active clouds have on physical and dynamical processes active in the current climate of Mars.